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Reply to Attn of: 305

March 6, 2014

NASA/John F. Kennedy Space Center
Mail Stop: SA-C3
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TO: Kennedy Space Center
Attn: SA-C3/Executive Secretary, KSC Ground Safety Review Panel (GSRP)

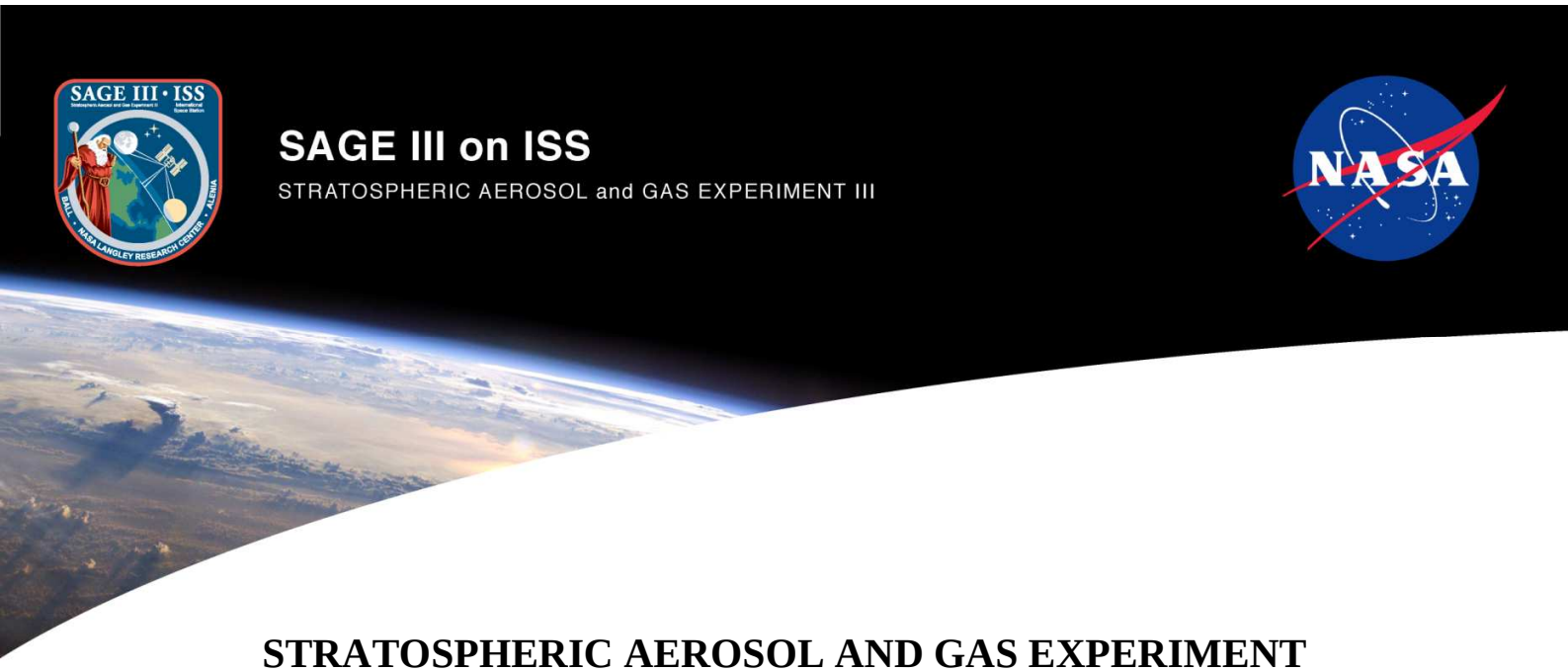
FROM: 416/LaRC Project Manager, Stratospheric Aerosol and Gas Experiment (SAGE III) on International Space Station (ISS), Nadir Viewing Platform (NVP) Assembly and Test

SUBJECT: Transmittal of SAGE III NVP Assembly and Test Phase 0/I/II/III Ground Safety Data Package

Attached is subject Phase 0/I/II/III Ground Safety Data Package submitted in accordance with SSP 30599, "Safety Review Process". Please direct any questions concerning the package content to Mr. K.C. Johnson, NASA Langley Research Center at 757-864-9408 or the undersigned at 757-864-1861.

Michael S. Cisewski
SAGE III on ISS, Project Manager

Enclosure



STRATOSPHERIC AEROSOL AND GAS EXPERIMENT (SAGE III ON ISS)

PHASE 0/I/II/III
NADIR VIEWING PLATFORM ASSEMBLY AND TESTING GROUND SAFETY COMPLIANCE DATA PACKAGE

DATE: MARCH 6, 2014

SAGE III-03-015

Approved for Public Release; Distribution is Unlimited

The electronic version is the official approved document.
Verify this is the correct version before use

SIGNATURE PAGE

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REVISION AND HISTORY PAGE

Status	Version	Change No.	Description	Release Date
	Baseline		NVP Flight Assembly KSC Ground Package	3/6/2014

FOREWORD

The following list is provided as points of contact for members of this Kennedy Space Center (KSC) Ground Safety Review Panel and direct support personnel.

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this Phase 0/I/II/III Nadir Viewing Platform (NVP) Ground Safety Data Package (GSDP) is to provide the International Space Station (ISS) Ground Safety Review Panel (GSRP) an interim safety assessment of the NVP flight hardware assembly operations at KSC. This package provides the data/information necessary to safely perform the assembly operations to eventually leading to safety certification by the GSRP.

This Safety Data Package (SDP) is the response to the requirements as specified in Space Station Program (SSP) 51700, "Payload Safety Policy and Requirements for the International Space Station" and KNPR 8715.3 "KSC Safety Practices Procedural Requirements," Chapter 20, "NASA KSC Payload and Cargo Safety Requirements". This data package is prepared in accordance with SSP 30599, "Payload Safety Review Process."

1.2 DOCUMENT CONTROL

This document is managed by the Stratospheric Aerosol and Gas Experiment III (SAGE III) on ISS project and, after initial approval, will be baselined and placed under configuration control using the change management processes defined in the SAGE III on ISS Project Information and Configuration Management Plan (SAGE III-01-003).

1.3 ORDER OF PRECEDENCE

All applicable documents referenced are to the latest baselined versions. Information presented in this document does not supersede applicable laws and regulations, unless a specific authorized exemption is obtained.

2 APPLICABLE AND REFERENCE DOCUMENTS

This section identifies all documents that are applicable to the SAGE III NVP ground activities or referenced in this document. Current versions are assumed, unless otherwise noted. If the GSDP conflicts with any of the following documents, these documents take precedence.

2.1 APPLICABLE DOCUMENTS

JSC 26943	Guidelines for the Preparation of Payload Flight Safety Data Packages and Hazard Reports
KNPR 8715.3	KSC Safety Practices Procedural Requirements
NASA-STD-8719.9	Standard for Lifting Devices and Equipment
NASA-STD-8739.4	NASA Technical Standard: Crimping, Interconnecting Cables, Harnesses, and Wiring
NPR 6000.1H	Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems Equipment and Associated Components
SAGE III-02-005	SAGE III Contamination Control Plan
SAGE III-02-10	SAGE III on ISS NVP Requirements Document

SAGE III-02-019	SAGE III on ISS Launch Design and Environments Constraints (LDEC)
SAGE III-02-033	Loads and Environments Definition Document (EDD)
SAGE III-03-001	SAGE III on ISS Product Assurance Plan
SAGE III-07-001	SAGE III on ISS Mission Concept of Operations (CONOPS)
SAGE III-10-001	SAGE III on ISS Transportation and Handling Plan
SAGE III-10-006	SAGE III on ISS Transportation and Handling Procedure
SAGE III-10-012	SAGE III on ISS NVP System Level Assembly, Integration, and Test Plan
SAGE III-05-331	SAGE III on ISS Transportation and Handling Procedure for Shipping.
SSP 30599	Safety Review Process
SSP 51700	Payload Safety Policy and Requirements for the International Space Station

2.2 REFERENCE DOCUMENTS

NNLAA46C	Shipping Container End Item Package,
National Space Transportation System (NSTS)/ISS 13830	Payload Safety Review and Data Submittal Requirements for Payloads using the Space Shuttle and International Space Station
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads using the International Space Station
NSTS 14046	Payload Verification Requirements
NSTS/ISS 18798	Interpretations of NSTS/ISS Payload Safety Requirements

3 MISSION OVERVIEW

3.1 MISSION OVERVIEW

From here-in, any references to SAGE III within the GSDP are by definition, references to the integrated configuration of the payload. (i.e. Nadir Viewing Platform (NVP) and the Instrument Payload (IP)). A commercial space vehicle will transport the NVP and IP payloads to the ISS. The SAGE III on ISS payload is the fifth in a series of instruments developed for monitoring aerosols and gaseous constituents in the stratosphere and troposphere. The SAGE III on ISS payload measures solar occultation, as shown in Figure 1; and similarly lunar occultation; and also measures the scattering of solar radiation in the Earth's atmosphere (called limb scatterings (LS)), as shown in Figure 2. These scientific measurements provide the basis for the analysis of five of the nine critical constituents identified in the U.S. National Plan for Stratospheric Monitoring. These five atmospheric components include the profiles of aerosols, ozone (O_3), nitrogen dioxide (NO_2), water vapor (H_2O), and air density using oxygen (O_2).

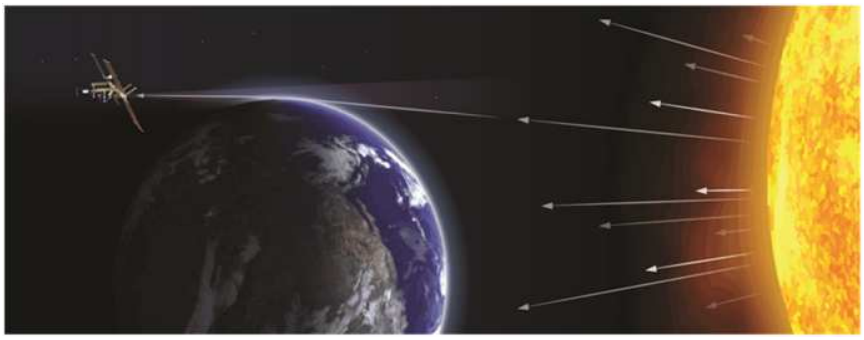

Figure 1: Solar Occultation

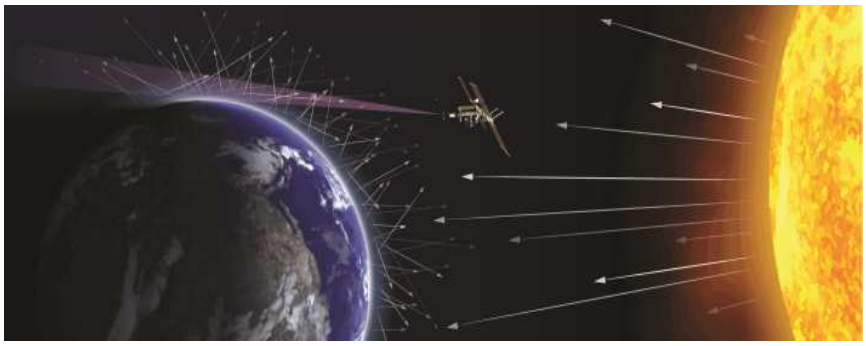

Figure 2: Limb Scattering Technique

The SAGE III payload is a moderate resolution spectrometer covering wavelengths from 290 nm to 1550 nm. Solar energy, attenuated by the Earth's atmosphere, is monitored in nine wavelength bands centered at 290, 385, 440, 525, 600, 760, 940, 1020, and 1550 nm. In addition to solar occultation, SAGE III payload is designed to measure lunar occultation between the first and third quarters of the lunar month. The reflected light from the moon provides a radiant source for making measurements of key nighttime atmospheric constituents such as nitrogen trioxide and chlorine dioxide. In addition to solar and lunar occultation, the SAGE III payload will perform LS measurements. The sunlight, scattered by atmospheric gases and particulates (aerosols and clouds) as well as by the earth's surface, is measured and spectrally dispersed by the SAGE III Payload high vertical resolution spectrometer.

3.2 SCIENCE OBJECTIVES

The SAGE III on ISS science objectives are to monitor the vertical distribution of aerosols and ozone and other trace gases in the Earth's stratosphere and troposphere to enhance understanding of ozone recovery and climate change processes in the upper atmosphere. SAGE III on ISS will extend the SAGE data record, that has been an anchor of international ozone trend assessments, and the long-term Stratospheric Aerosol Measurement (SAM)/SAGE aerosol data record. In addition, SAGE III will provide vertical profiles of trace gases such as water vapor and nitrogen dioxide that play significant roles in atmospheric radiative and chemical processes. The state of the recovery in the distribution of ozone will be assessed. In addition, SAGE III on ISS will

provide aerosol measurements needed by the Climate and Ozone modeling Countries (COC), and will gain further insight into the key processes contributing to ozone and aerosol variability.

3.3 MISSION DESCRIPTION

The SAGE III payload hardware, shown in Figure 3, has two main elements: the IP (figure on the right), which obtains solar and lunar occultations and LS measurements and, the NVP (figure on the left), which is a passive structural system that enables the SAGE III IP to attach to the Expedite the Processing of Experiments to Space Station (ExPRESS) Logistics Carrier (ELC) -4 on the ISS. To obtain the nadir viewing capability, the NVP provides a mounting surface that enables the IP to be rotated ninety degrees from the plane of the ELC-4.

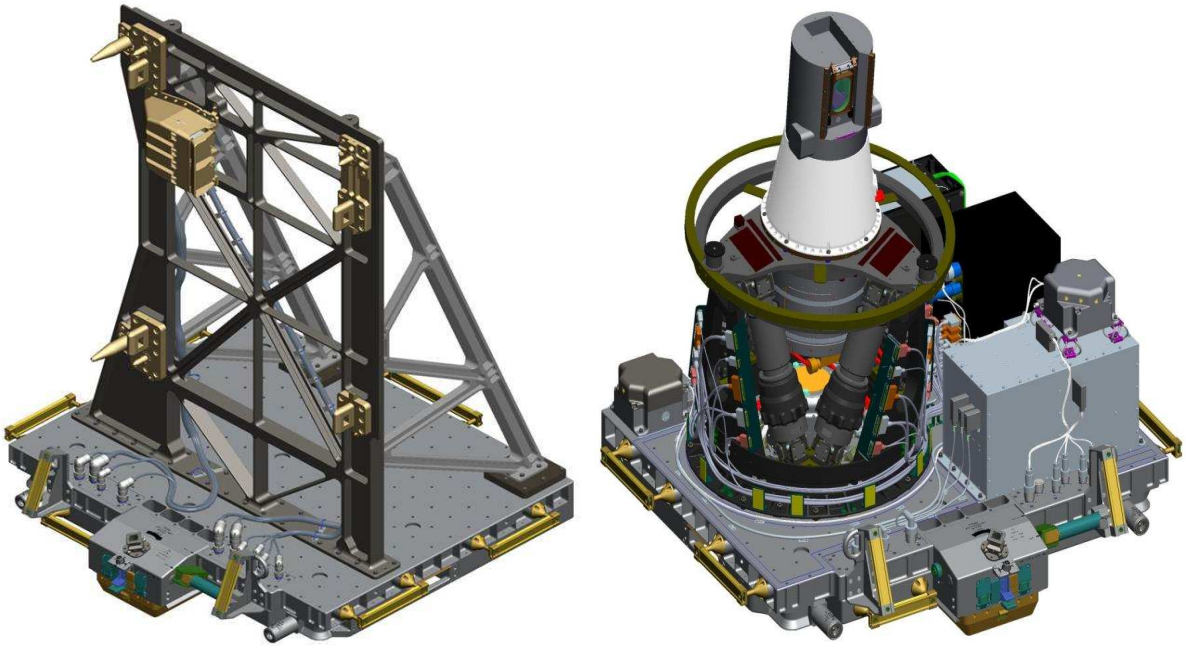

Figure 3: NVP and IP Elements

The launch operations includes all of the systems and facilities required to launch the SAGE III IP and NVP and rendezvous with the ISS, including integration and testing (I&T) with the launch vehicle and associated capsule, as well as, all associated launch site operations and the actual launch. The launch operations begin at the ground processing and I&T in the Space Station Processing Facility (SSPF) at the Kennedy Space Center (KSC) and ends when the SAGE III system is installed on the ISS. The SAGE III project will support the International Space Station Program Office (ISSPO) Launch Segment activities. It is planned that the SAGE III payload will be flown on the SpaceX Falcon 9 expendable launch vehicle in the unpressurized cargo section ("Trunk") of the Dragon capsule.

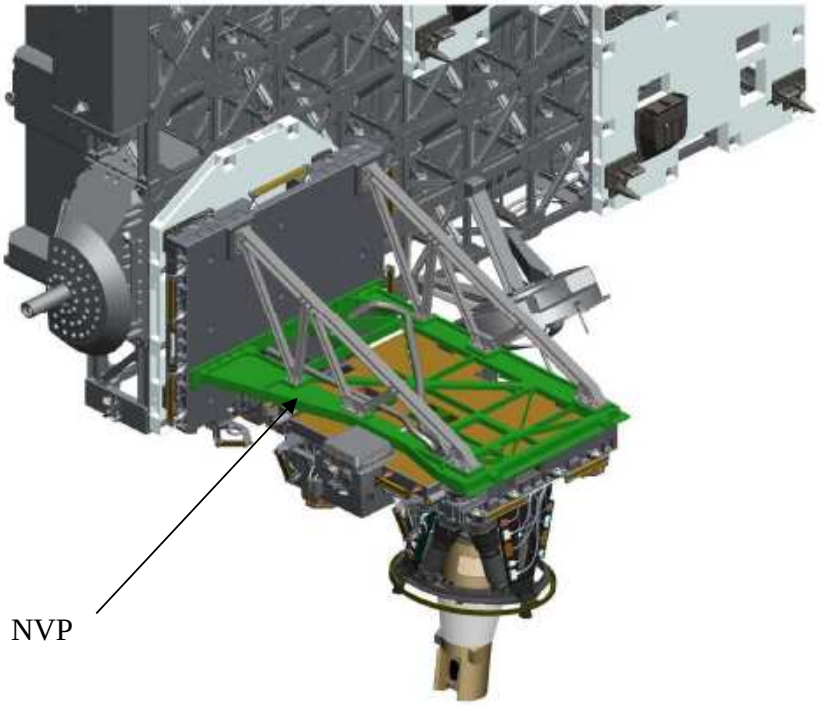

Figure 4: SAGE III Payload On-Orbit Configuration (with IP and NVP combined)

4 NADIR VIEWING PLATFORM (NVP)

The NVP is a passive structural system that enables attachment of the SAGE III IP to the ELC4 on the ISS. The NVP provides mounting for the IP by replicating the ELC Passive Flight Releasable Attachment Mechanism (PFRAM) attachment mounted ninety degrees to the plane of the ELC4.

The NVP consists of the following main elements as shown below:

- **PFRAM Interface Plate (PFIP)** attaches to the support structure truss and provides a mounting structure for the PFRAM hardware. This is new hardware being developed by the SAGE III project
- **PFRAM** mounts to the NVP PFIP. The passive part of the mechanism allows the SAGE III IP to be robotically attached to the NVP assembly. This hardware will be provided to the Project by the ISS program
- **Truss/Support Structures** are trusses that attach to the ExPA plate and provide a mounting structure for the PFRAM that allows the SAGE III instrument to be installed pointing nadir. This is new hardware being developed by the SAGE III project
- **ExPA Interface Plates** are a series of metal plates that make up the interface between the ExPA and the rest of the NVP structural subassembly
- **ExPA** is a device used to mount external payloads to the ELC on ISS. This hardware will be provided to the Project by the ISS program. It consists of two major components:

- The Active Flight Releasable Attachment Mechanism **(AFRAM)** is an active part of the mechanism that allows the NVP assembly to be robotically attached to the ISS and provides electrical pass through connections

- ExPA Plate is attached to the AFRAM and provides a structural mounting through a square grid interface. The NVP components are attached to the surface of this plate

- **Power and Data Cables** provide the electrical connections between the ExPA and the NVP PFRAM

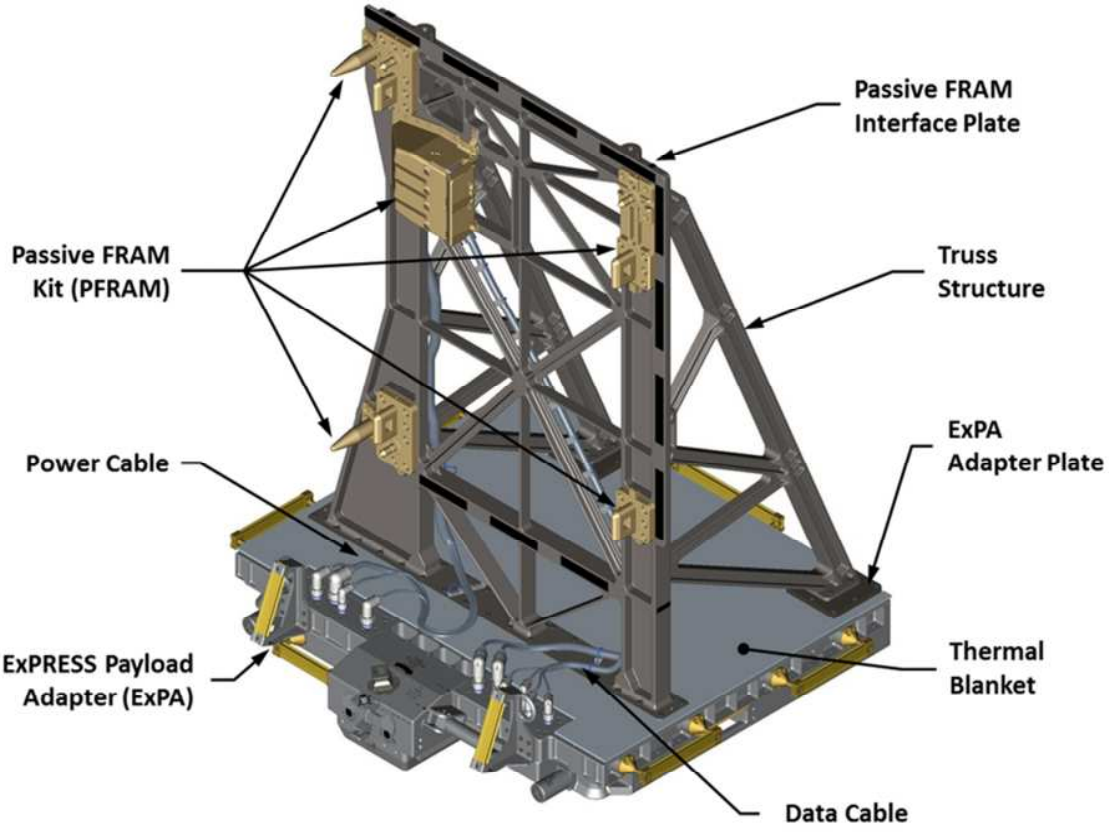

Figure 5: Nadir Viewing Platform (NVP)

All cables are shielded and tied to PFRAM housing backshells, which are connected to chassis through the connectors. A braid will be clamped at the blind mate connector backshell and tied to the PFIP. The ExPA connects to the ELC PFRAM.

5 MATERIALS

There are no unique materials used in the manufacture of the NVP payload. There are no flammable/hazardous materials used. The NVP hardware will be delivered to the Space Station Processing Facility (SSPF) at KSC. Prior to their enclosure in their respective shipping containers, the NVP Flight hardware will be double-bagged with llumalloy metalized film and

secured with non-silicone low-residue adhesive tape per the SAGE III Contamination Control Plan, SAGE III–02–005.

6 GROUND TRANSPORTATION TO KSC

The Logistics, Transportation, And Handling Plan, SAGE III–10–001, addresses all the transportation and handling of the top-level flight assemblies, the IP and NVP, as well as flight sub-systems, components, engineering design units (EDU) and the associated Ground Support Equipment (GSE). The SAGE III flight hardware and associated GSE will be packaged per the SAGE III on ISS Transportation and Handling Procedure, SAGE III–10–006, staged and secured for transport. The LaRC procedure for shipping is SAGE III-05-331, Transportation and Handling Procedure for Shipping NVP Payload/IP ExPA from LaRC to KSC.

The NVP flight hardware will be designated as Class I Shipping and Handling and Level B Protection per NPR 6000.1H, "Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems Equipment and Associated Components" and LPR 8739.21, "LaRC Procedures and Guidelines for Electro-Static Discharge (ESD) Control of Electrostatic Discharge Sensitive (ESDS) Devices Program" during the performance of all the transportation functions. The NVP flight hardware contains no hazardous material.

6.1 TRANSPORTATION AND HANDLING PROCEDURES

SAGE III Project will perform all necessary steps and precautions to ensure safe transportation of flight hardware. SAGE III transportation and handling procedures will contain the appropriate safety awareness information required to identify where potentially hazardous events may exist during the performance of a particular operation. The payloads are double bagged with humidity indicator cards and desiccant bags when outside clean room areas. Transportation load limits are documented in SAGE III-02-033, Loads and Environments Definition Document (EDD). Shipping Containers are equipped with data loggers, and witness plates, and backfilled with GN_2.

All post-delivery transportation and handling operations at NASA KSC will be performed by KSC generated procedures with input from the SAGE III project. The NVP flight hardware is not to be considered hazardous material.

7 KSC GROUND PROCESSING FLOW

7.1 SSPF GROUND PROCESSING OPERATIONS

LaRC will ship the NVP/ExPA payload and IP ExPA to KSC/SSPF. Upon arrival at KSC SSPF and prior to unloading from the truck, a cursory inspection of the hardware will be conducted by the SAGE III logistics representative and the LaRC S&MA representative to check for any obvious damage or load shifting. Shipment handling will include removal of protective devices, environmental monitoring equipment, and inspection of the flight hardware. The tie-down equipment will be removed and stowed. A ground processing block diagram is located in Figure 5.

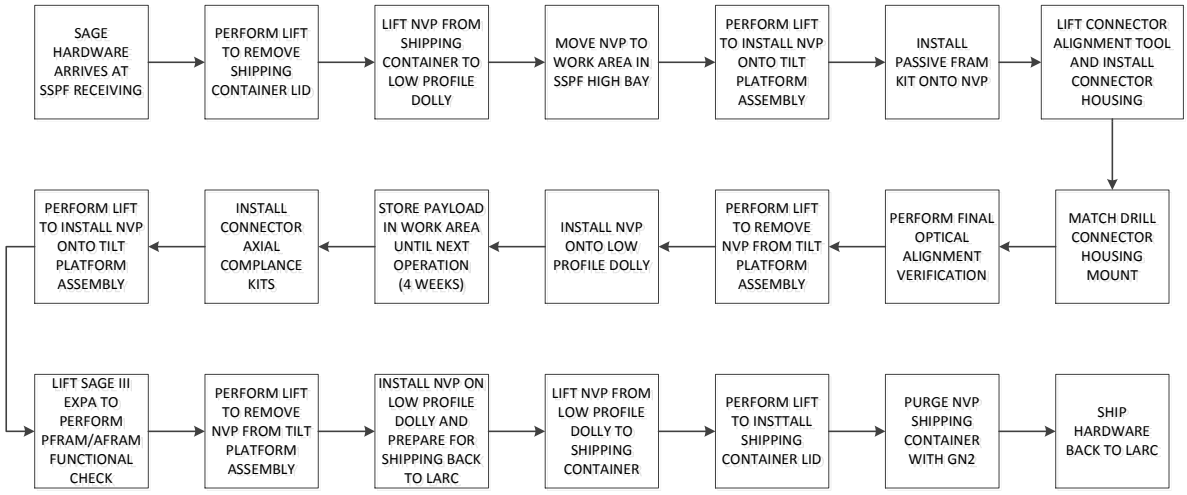

Figure 6: NVP Ground Processing Flow

8 MECHANICAL GROUND SUPPORT EQUIPMENT (MGSE)

8.1 LIFTING AND HANDLING EQUIPMENT

KSC lifting and handling GSE will be used for NVP ground processing activities. The PFRAM hardware is mounted to the NVP interface plate using the KSC Low Profile Dolly in the SSPF. A mechanical fit check of the IP ExPA to the NVP will also be performed. The KSC LOLS (Large ORU Lifting Sling) and HUBS (Horizontal Universal Bracket System) are specifically designed for lifting the ExPA and NVP Payload. The Low Profile Dolly (LPD) is used is used for transportation. Using KSC GSE and lifting devices, KSC developed assembly procedure (SS-SPX-006-SAGE III-T7913), and KSC operators, the NVP assembly with the PFRAM is accomplished. No personnel underneath the suspended load or suspended load operations are permitted.

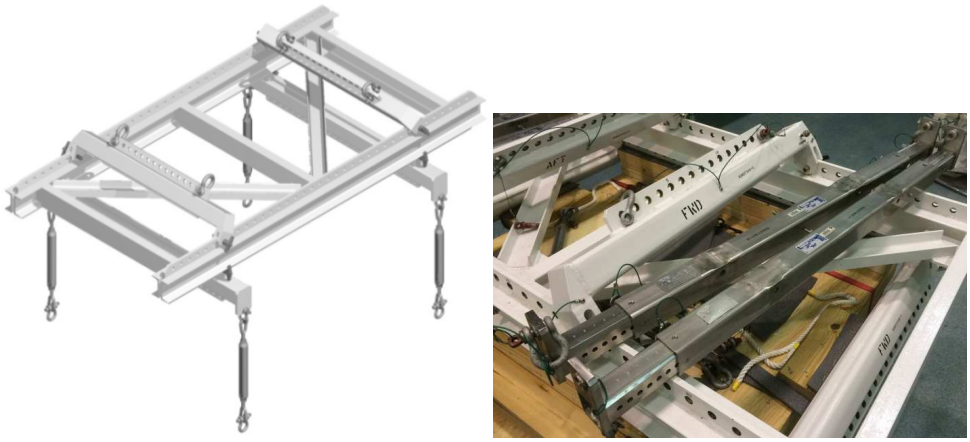

Figure 7: KSC LOLS and HUBS Bracket System

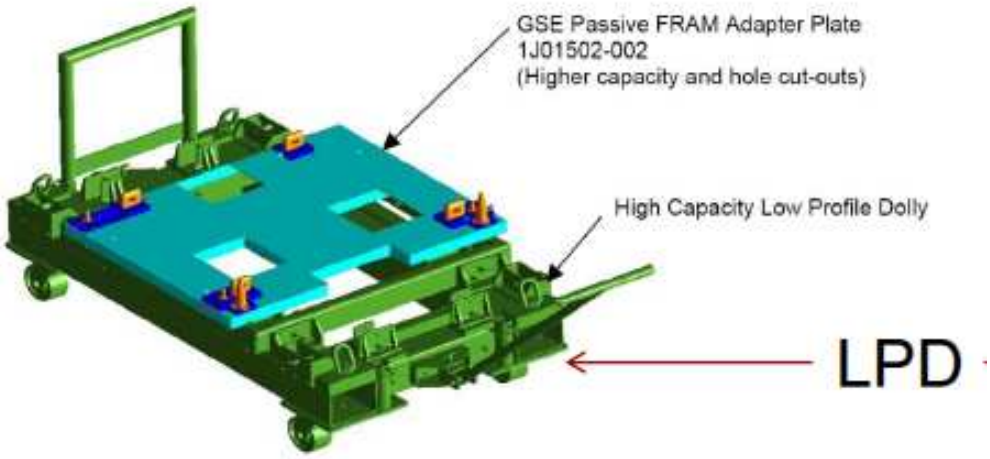

Figure 8: KSC Low Profile Dolly

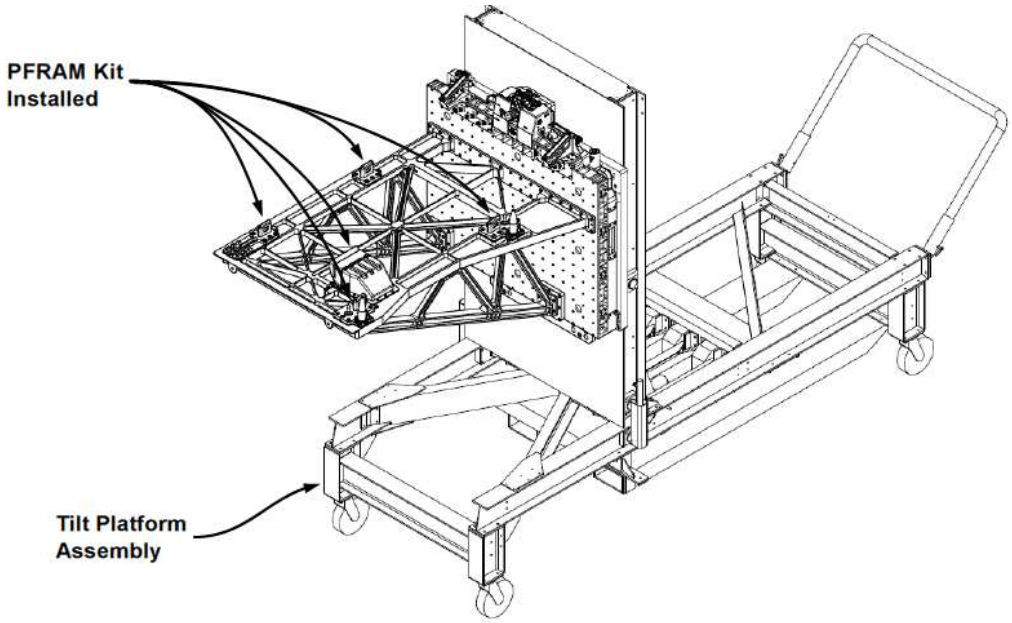

Figure 9: KSC Tilt Platform Assembly with NVP

Figure 10: LaRC GSE Cart

8.2 SHIPPING CONTAINERS

The NVP Payload will have an individual, custom-made shipping container. The individual payloads will be protected from transportation loads by a shock isolation subsystem. The shipping container is manufactured using materials certified by the SAGE III Contamination Control Engineer to comply with SAGE III-02-005. Once the NVP is installed in its shipping

container, the containers, designed with a pressure relief valve, will be purged with dry, gaseous nitrogen prior to shipment.

The base of the NVP Shipping Container is designed with metallic structural material and certified per NPR 6000.1H, "Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components," to a load of 1000 lbf with a factor of safety of 2.0 based on the minimum yield strength of the metallic structural material. The base of the shipping container is designed to allow lifting by forklift from all four sides with their cover segments to be independently removable either by overhead crane or forklift boom.

Figure 11: Shipping Container

9 ELECTRICAL GROUND SUPPORT EQUIPMENT

The CableEye HVX Test System is Commercial-Off-The-Shelf (COTS) equipment. The tester has not been modified from its original design/operation. The test equipment will be used within its intended parameters. The National standard or testing organization used is Conformance European (CE) Tested for electrical safety and electromagnetic emissions The HVX System has undergone a rigorous series of tests at the Massachusetts Laboratory of Bureau Veritas to confirm the product meets the safety and electromagnetic compatibility standards for the CE Mark.

Electrical continuity testing using a CableEye Cable Test System will be performed per TPS to verify cable harness and connections operability. It checks blind mate connection with IP ExPA (continuity only) and also checks NATC connection with NVP ExPA (continuity). GSE used for this continuity test are the Tilt Platform Assembly, LPD, test cables, CableEye Cable Test System, and break out box

Figure 12: CableEye High Voltage Test System

9.1 EGSE TEST OPERATIONS

This phase of NVP flight assembly involves the installation and alignment of the NVP PFRAM kit to the NVP assembled structure.

Once the PFRAM components have been installed on the NVP, the blind mate connector end of the cable harnesses will be installed at the compliant connector housing (the NVP ExPA side of the cable will remain uninstalled until the Phase III Assembly at LaRC) in order to support functional testing of the electrical connections.

LaRC Quality Assurance will be present during the assembly and testing at KSC. The procedure will be performed in accordance with the contamination control process developed by KSC, and the SAGE III on ISS Contamination Control Plan, SAGE III-02-005.

Once complete with these evolutions, the NVP will be shipped to back to LaRC where a cleanliness assessment (and cleaning as necessary) will take place prior to the third phase of assembly.

9.2 INTERFACE FIT CHECK

After the PFRAM kit and cable harnesses have been installed, the PFRAM will undergo a mechanical fit check with the IP ExPA to which it will mate on orbit using KSC's Tilt Platform Assembly (TPA) that allows orientation and support of the equipment for mating while in a 1-g environment. This fit check will demonstrate the ability to mate the IP to the NVP on orbit. At this time an electrical function check with the IP ExPA will also be conducted.

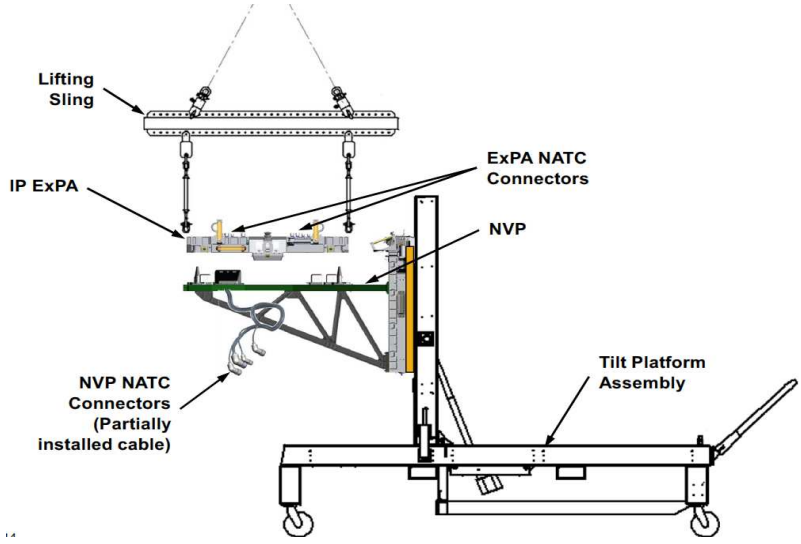

Figure 13: PFRAM/ExPA Interface Fit Check

9.3 ELECTRICAL CONTINUITY TEST

Electrical Continuity checks will be made on the flight cable harnesses upon completion of the PFRAM assembly to the NVP. These tests will be conducted per NASA STD 8739.4 (Section 18, Inspection and Testing) with the high potential test voltage reduced to 500V. Completed interconnecting harnesses and cables are verified as meeting all applicable functional, electrical, and design requirements.

9.4 ELECTRICAL CONTINUITY TEST OBJECTIVE

This continuity test will be conducted with the NVP Flight Cable Harness installed on the compliant connector housing during the mechanical test fit with the IP ExPA. While the NVP Flight Cable Harness blind mate connectors are mated with the IP ExPA, the test will be performed between the NASA Treaded Coupling (NATC) connectors of the NVP Flight Cable Harness and the NATC connectors of the IP ExPA. This test provides reasonable assurance that the blind mate connectors will function properly on orbit. This test will be performed utilizing LaRC Task Performance Sheets (TPS). The EGSE required for this test are the test cable harnesses, the Automated Continuity / Hipot Tester, and Break out Box (BOB).

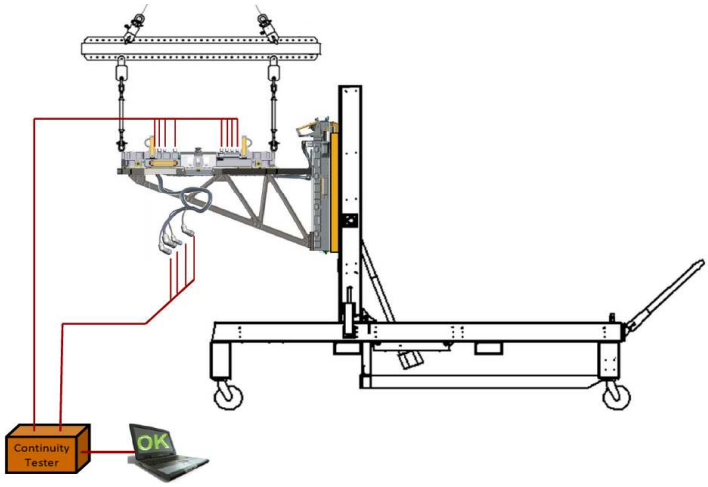

Figure 14: Electrical Continuity Setup

10 NONCONFORMANCE REPORTS

If a ground safety requirement cannot be met, a Noncompliance Report (NCR) will be submitted in accordance with SSP 30599 for resolution. Where the payload design has not been met for a specific safety requirement, but can demonstrate it achieves an acceptable level of safety, an Accepted Risk Hazard Report (ARHR) in lieu of an NCR may be permitted. All NCRs/ARHRs will be coordinated with the Ground Safety Review Panel (GSRP), as appropriate, as soon as it is determined that the safety requirement cannot be met. Currently there is one Flight NCR, "EVA Loads with Pinch Point/Appendage Entrapment" and it is associated with the flight IP. **There are no NCR's for the NVP**.

11 SAFETY ANALYSIS APPROACH

The SAGE III on ISS payload will conduct a Phase III Ground Safety Review as instructed by SSP 30599, "Safety Review Process." All GSE hardware design and ground processing operations will be in compliance with the requirements of the KNPR 8715.3 "KSC Safety Practices Procedural Requirements," Chapter 20, "NASA KSC Payload and Cargo Safety

Requirements". The current schedule is to ship the SAGE III IP and NVP separately and be on-dock at KSC, no earlier than April 2015.

11.1 HAZARD IDENTIFICATION

The primary objectives of the safety review process are to identify the potential ground hazards applicable to processing the payload/GSE and to assure that the hazard controls and verifications are adequate and in compliance with the ground safety requirements. The safety hazard analysis in this SDP pertains to potential ground processing hazards only.

11.2 GROUND HAZARD ANALYSIS

The purpose of the Phase 0/I/II/III ground hazard report is to document the payload organization's safety assessment in a manner that reflects how the payload design demonstrates compliance with the KSC ground processing safety requirements. The ground hazard report is used as a method to systematically assess compliance with the safety requirements. The GSDP is intended to comply with the instructions, definitions, and requirements specified in SSP 30599. The safety analysis results are documented in the GSDP, Appendix A, which includes applicable payload hazard report forms (JSC Form 542B) for presentation to the KSC GSRP.

For the hazard analysis, hazard controls are identified for each hazard cause. A direct correlation between each hazard cause and the corresponding hazard control(s) is demonstrated with sufficient supporting information detailing each hazard control. Verifications will include the types of tests, analyses, inspections, or demonstrations and/or procedures to be used to verify each hazard control. KSC is responsible for safety verification of their GSE and lifting devices. A direct correlation between each verification method and the corresponding hazard control are shown in each report. Each verification item is independent and has a designator that allows for individual tracking of verification status. Control verifications not completed by the Phase III data package review are transferred and documented into the Safety Verification Tracking Log (SVTL) and tracked until closure. If there are open flight verifications that are constraints to ground processing, those items will be documented on the ground SVTL. **The SVTL is located in Appendix B.** The Certificate of NSTS/ISS Payload Safety Compliance is in Appendix C.

11.3 GROUND HAZARD ANALYSIS SUMMARY

The hazards identified in the analysis are the following:

1) Hazard Report NVP-GHR-01, Electric Shock – This potential hazard is generated by personnel in contact with voltage greater than 50 VDC or 30 VRMS which results in electrical shock leading injury/death to personnel. It is controlled by circuitry design, proper grounding/bonding, and operating procedures.

2) Hazard Report NVP-GHR-02, Ignition of Flammable Materials - Potential ignition of flammable materials may be associated with NVP during ground processing resulting in loss of the payload, and/or processing facility. It is controlled by electrical design and proper selection of plastic films and tape.

The following systems are not applicable to the NVP Payload:

- Ionizing radiation
- Non-ionizing radiation
- Batteries
- Avionic controls
- Pyrotechnic devices
- Solid rocket motors
- Fluid propulsion systems
- Fire detection and suppression
- Pressure system
- Hydraulic system
- Pneumatic system
- Flammable liquids
- Hazardous materials

APPENDIX A: GROUND HAZARD REPORTS

PAYLOAD HAZARD REPORT		a. NO:	NVP-GHR-01
b. PAYLOAD: SAGE III on ISS (NVP)		c. PHASE:	0/I/II/III
d. SUBSYSTEM: Electrical	e. HAZARD GROUP: Injury/Illness	f. DATE:	
g. HAZARD TITLE: Electrical Shock		i. HAZARD CATEGORY X CATASTROPHIC ☐ CRITICAL	
h. APPLICABLE SAFETY REQUIREMENTS: KNPR 8715.3, sec. 20.6.2 Electrical			
j. DESCRIPTION OF HAZARD: Personnel contact with high voltage sources greater than 50 VDC or 30 VRMS from payload or GSE results in electrical shock leading injury/death to personnel			
k. HAZARD CAUSES: 1. Personnel contact voltage source and/or conductive surfaces (e.g. exposed terminals) 2. Inadequate grounding/bonding 3. Improper handling or operator error 4. Operation of equipment with improper interface power phasing			
l. HAZARD CONTROLS: See Continuation Sheet			
m. SAFETY VERIFICATION METHODS: See Continuation Sheet			
n. STATUS OF VERIFICATION: See Continuation Sheet			

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III		

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO:	NVP-GHR-01
b. PAYLOAD: SAGE III on ISS (Instrument Payload and NVP)	c. PHASE:	0/I/II/III

k. HAZARD CAUSES:

1. Personnel contact voltage sources and/or conductive surfaces (e.g. exposed terminals)
2. Inadequate grounding/bonding
3. Improper handling or operator error

l. HAZARD CONTROLS:

1.1 Hazardous voltage sources in the EGSE are enclosed and inaccessible to personnel.

2.1 NVP hardware and GSE conductive external surfaces are grounded and the ground connected to facility ground.

3.1 Inadvertent mismating of electrical connectors is not possible by design.

3.2 Use of approved procedure for handling, checkout, and testing of EGSE.

m. SAFETY VERIFICATION METHODS:

1.1.1 Inspection of EGSE hardware for proper guarding prior to application of power

2.1.1 Inspection of NVP hardware and GSE for proper grounding

3.1.1 Review electrical connector design to ensure mismating is not possible

3.2.1 Approval of EGSE handling, checkout, and testing procedure

n. STATUS OF VERIFICATION:

1.1.1 Closed. Cable Eye HVX, High Voltage Test System manufacturer data sheet, 2/25/14

2.1.1 Closed to SVTL

3.1.1 Closed. Cable Eye HVX, High Voltage Test System manufacturer data sheet, 2/25/14

3.2.1 Closed to SVTL

JSC Form 542B (Rev April 1, 1999) (MS Word September 1997)

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO:	NVP-GHR-01
b. PAYLOAD: SAGE III on ISS (Instrument Payload and NVP)	c. PHASE:	0/I/II/III

k. HAZARD CAUSES:

4. Operation of equipment with improper interface power phasing

l. HAZARD CONTROLS:

4.1 Three-phase facility power sequencing is verified per procedure in each KSC processing facility prior to connection.

m. SAFETY VERIFICATION METHODS:

4.1.1 Review test procedure to ensure testing of KSC facility three phase power receptacle prior to conducting test procedure.

n. STATUS OF VERIFICATION:

4.1.1 Closed to VTL

JSC Form 542B (Rev April 1, 1999) (MS Word September 1997)

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CableEye® HVX Technical Specifications

	Low Voltage	High Voltage
Test Points Available	128, switch selectable to 64 or 128.	(same)
Expandability	Expandable to 512 TP in increments of 128 by adding optional HVAEX expansion modules.	(same)
Test Time	0.25 second with two resistance thresholds, 0.2 second with one threshold.	Depends on voltage, ramp rate, and test algorithm. Linear and "Quick Hipot" available
USB Interface	USB 1.1, Fast, M3U Module	USB 1.1, Fast, HVX Module
Resistance Thresholds	Two, each variable from 0.3 Ω to 10 MΩ	
Resistance Measurement	Measure embedded resistors with 1% accuracy from 100 Ω to 1 MΩ, lesser accuracy from 0.3 Ω to 10 MΩ.	
Diode Measurement	Yes, learns automatically. Diode networks measured. Proper position and polarity reported. Forward voltage measured.	
Test Voltage	10v DC bidirectional	10 – 1500 vDC in Increments of 1 v 10 – 1000 vAC RMS in Increments of 1 v
Test Voltage Accuracy		DC: ±2%, ±1.5 v AC: ±4%, ±2 v RMS
Maximum Test Current	1.0 ma maximum	Settable, 50 µa to 1.5 ma
Dielectric Withstand Range		DC: 25 µA – 1.5 ma AC: 100 µA – 1.5 ma
Dielectric Withstand Theshold Accuracy		DC: ±5%, ±5µA AC: ±5%, ±100 µA
Dwell Time Range	1 µS to 64 ms	10 ms – 300 sec, in increments of 1 ms
Insulation Resistance Measurement Range		DC: 2 MΩ – 1 GΩ at 1500 vDC, ±5% AC: 2 MΩ min (high depends on adapter leakage)
Calibration	Recomended yearly. May be necessary yearly by ISO certification requirements.	
Test Point Connectors	64-pin dual-row headers, 0.1" centers. Two per 128-point module.	
Remote Control Socket	miniDIN8 connector for footswitch, external control panel. Also remote HV Enable and Stop	
Power Requirement	100-250vAC, 65w maximum. IEC-standard universal C14 chassis plug.	
Weight	21 lbs (9.5 kG)	
Computer Requirements	Any Windows-capable machine running Windows XP or above. Compatible with laptop PCs.	
High Voltage Safety Features	Login privilege for HV set by system admin, HV Enable required at start of session, fast shutdown if 1.5 µA maximum current exceeded, internal and remote HV "on" indicators.	
Warranty	One year parts and labor. Renewable yearly. Includes free software upgrades and tech support.	

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Acton, Massachusetts 01720
Tel: (978) 266-2655 or Fax: (978) 266-2658
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www.camiresearch.com

PAYLOAD HAZARD REPORT		a. NO:	NVP-GHR-02
b. PAYLOAD: SAGE III on ISS (NVP)		c. PHASE:	0/I/II/III
d. SUBSYSTEM: Electrical	e. HAZARD GROUP: Fire	f. DATE:	
g. HAZARD TITLE: Ignition of Flammable Materials		i. HAZARD CATEGORY X CATASTROPHIC ☐ CRITICAL	

h. APPLICABLE SAFETY REQUIREMENTS:

KNPR 8715.3, Sec. 20.6.2.1
KTI 5212, Material Selection List for Plastic Films, Foams, and Adhesive Tapes
29CFR 1910.1200, Hazard Communication

j. DESCRIPTION OF HAZARD:

Potential ignition of flammable materials may be associated with NVP during ground processing resulting in loss of the payload, and/or processing facility.

k. HAZARD CAUSES:

1. Use of potential flammable materials
2. Arcing or sparks due to improper connection or disconnection of powered circuits
3. Overheating of electrical equipment

l. HAZARD CONTROLS:

See Continuation Sheet

m. SAFETY VERIFICATION METHODS:

See Continuation Sheet

n. STATUS OF VERIFICATION:

See Continuation Sheet

o. APPROVAL	PAYLOAD ORGANIZATION	SSP/ISS
PHASE I		
PHASE II		
PHASE III		

PAYLOAD HAZARD REPORT CONTINUATION SHEET	a. NO:	NVP-GHR-02
b. PAYLOAD: SAGE III on ISS (Instrument Payload and NVP)	c. PHASE:	0/I/II/III

k. HAZARD CAUSES:

1. Use of potential flammable materials
2. Arcing or sparks generated from improper connection or disconnection of powered circuits
3. Overheating of electrical equipment

l. HAZARD CONTROLS:

1.1 Plastic film and bagging materials are selected from the NASA KSC KTI-5212, Plastic Films and Adhesive Tapes approved list. A list of GSE Materials is attached.

2.1. Electrical connectors are designed to prevent improper connection or disconnection.

3.1 EGSE design protects against overvoltage and overcurrent conditions by using fuses, circuit breakers, and current limiters.

m. SAFETY VERIFICATION METHODS:

1.1.1 Review of plastic film, tape, and bagging material for NASA KSC KTI-5212 compliance

1.1.2 Review Safety Data Sheets (SDS)

2.1.1 Review of electrical connector design

3.1.1 Review of electrical design

n. STATUS OF VERIFICATION:

1.1.1 Closed. Plastic film and tape identified in KTI-5212 per SAGE III 02-005, Contamination Control Plan, 7/13/2013

1.1.2 Closed. Reviewed SDS, 2/28/2014

2.1.1 Closed. Cable Eye HVX, High Voltage Test System manufacturer data sheet, 2/25/14

3.1.1 Closed. CableEye HVX, High Voltage test System specification data sheet, 2/25/14

JSC Form 542B (Rev April 1, 1999) (MS Word September 1997)

GSE MATERIAL LIST

ND NAME / MANUFACTURER	SUBSTANCE (SOLVENT, EXPOXY, PLASTIC FILM, ETC)	QUANTITY	PROCESSING LOCATION AT KSC	USE	MSDS FORWARDED TO KSC? (YES/NO)
3M 8403	Green Polyester Film Tape	6 rolls (2 ea - 1", 2", & 3")	SSPF	Clean area operations	Yes Attachment
Milliken Anticon Gold	Clean Room Wipes	1 pkg	SSPF	Wipes for cleaning	No
CPF Films (now Solutria) As available	Llumalloy HSC	Roll	SSPF	For shipping/transportation	Yes Attachment
Tyvek S5166	Desiccant Bags	3x4x1/4 bags 2.5 gal	SSPF	For shipping container transportation	Yes Attachment
Engineering Materials Inc. LF8900-C As available	Flame Retardant AT Fim	5 mils One roll	SSPF	For shipping/transportation	Yes Attachment

3M

Material Safety Data Sheet

This material safety data sheet (MSDS) is provided as a courtesy in response to a customer request. This product is not regulated under, and a MSDS is not required for this product by the OSHA Hazard Communication Standard (29 CFR 1910.1200) because, when used as recommended or under ordinary conditions, it should not present a health and safety hazard. However, use or processing of the product not in accordance with the product's recommendations or not under ordinary conditions may affect the performance of the product and may present potential health and safety hazards.

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: 3M(TM) Polyester Tape 8403
MANUFACTURER: 3M
DIVISION: Industrial Adhesives and Tapes Division

ADDRESS: 3M Center
St. Paul, MN 55144-1000

EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)

Issue Date: 09/01/2006
Supercedes Date: Initial Issue

Document Group: 21-8702-9

Product Use:
Specific Use: Attachment/Reinforcement

SECTION 2: INGREDIENTS

Ingredient	C.A.S. No.	% by Wt
Polyester Backing	None	60 - 85
Silicone Adhesive	Trade Secret	15 - 40

SECTION 3: HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Specific Physical Form: Roll of Tape
Odor, Color, Grade: Translucent green tape.
General Physical Form: Solid
Immediate health, physical, and environmental hazards: The environmental properties of this product present a low environmental hazard. This product, when used under reasonable conditions and in accordance with the 3M directions for use, should not present a health hazard. However, use or processing of the product in a manner not in accordance with the product's directions for

use may affect the performance of the product and may present potential health and safety hazards.

3.2 POTENTIAL HEALTH EFFECTS

Eye Contact:
No health effects are expected.

Skin Contact:
No health effects are expected.

Inhalation:
No health effects are expected.

Ingestion:
No health effects are expected.

SECTION 4: FIRST AID MEASURES

4.1 FIRST AID PROCEDURES

The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.

Eye Contact: No need for first aid is anticipated.

Skin Contact: No need for first aid is anticipated.

Inhalation: No need for first aid is anticipated.

If Swallowed: No need for first aid is anticipated.

SECTION 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Autoignition temperature	*Not Applicable*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*Not Applicable*
Flammable Limits - UEL	*Not Applicable*

5.2 EXTINGUISHING MEDIA
Use fire extinguishers with class B extinguishing agents (e.g., dry chemical, carbon dioxide).

5.3 PROTECTION OF FIRE FIGHTERS

Special Fire Fighting Procedures: Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards: No unusual fire or explosion hazards are anticipated.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Accidental Release Measures: Not applicable.

SECTION 7: HANDLING AND STORAGE

7.1 HANDLING
This product is considered to be an article which does not release or otherwise result in exposure to a hazardous chemical under normal use conditions.

7.2 STORAGE
Not applicable.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS
Not applicable.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection
Avoid eye contact.

8.2.2 Skin Protection
Avoid prolonged or repeated skin contact. Gloves are not required.

8.2.3 Respiratory Protection
Under normal use conditions, airborne exposures are not expected to be significant enough to require respiratory protection.

8.2.4 Prevention of Swallowing
Not an expected route of exposure.

8.3 EXPOSURE GUIDELINES

None Established

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Specific Physical Form:	Roll of Tape
Odor, Color, Grade:	Translucent green tape.
General Physical Form:	Solid
Autoignition temperature	*Not Applicable*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*Not Applicable*

Flammable Limits - UEL	*Not Applicable*
Boiling point	*Not Applicable*
Density	*Not Applicable*
Vapor Density	*Not Applicable*
Vapor Pressure	*Not Applicable*
Specific Gravity	*Not Applicable*
pH	*Not Applicable*
Melting point	*Not Applicable*
Solubility in Water	Nil
Evaporation rate	*Not Applicable*
Volatile Organic Compounds	*Not Applicable*
Percent volatile	*Not Applicable*
VOC Less H2O & Exempt Solvents	*Not Applicable*
Viscosity	*Not Applicable*

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable.

Materials and Conditions to Avoid: None known

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition: Under recommended usage conditions, hazardous decomposition products are not expected. Hazardous decomposition products may occur as a result of oxidation, heating, or reaction with another material.

SECTION 11: TOXICOLOGICAL INFORMATION

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

Not determined.

CHEMICAL FATE INFORMATION

Not determined.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Method: Reclaim if feasible. If product can't be reclaimed, dispose of waste product in a sanitary landfill. Alternatively, incinerate the waste product in an industrial, commercial, or municipal incinerator.

Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14:TRANSPORT INFORMATION

ID Number(s):
70-0000-4419-1, 70-0061-0384-3, 70-0061-0385-0, 70-0061-0386-8, 70-0061-0387-6, 70-0061-0388-4, 70-0061-0389-2, 70-0062-1186-9, 70-0062-1191-9, 70-0062-1196-8, 70-0062-1198-4, 70-0062-1199-2, 70-0062-1201-6, 70-0062-2692-5, 70-0062-2693-3, 70-0062-6103-9, 70-0062-6237-5, 70-0062-6319-1, 70-0062-7642-5, 70-0063-4702-8, 70-0063-7146-5, 70-0063-7521-9, 70-0063-7558-1, 70-0063-7589-6, 70-0063-7761-1, 70-0063-7776-9, 70-0160-4133-0, 70-0160-4935-8, 70-0160-4988-7, 70-0160-4992-9, 70-0160-5361-6, 70-0160-5639-5, 70-0160-5641-1

Not regulated per U.S. DOT, IATA or IMO.

These transportation classifications are provided as a customer service. As the shipper YOU remain responsible for complying with all applicable laws and regulations, including proper transportation classification and packaging. *3M's transportation classifications are based on product formulation, packaging, 3M policies and 3M's understanding of applicable current regulations. 3M does not guarantee the accuracy of this classification information. This information applies only to transportation classification and* ***not*** ***the packaging, labeling, or marking requirements.*** *The original 3M package is certified for U.S. ground shipment only. If you are shipping by air or ocean, the package may not meet applicable regulatory requirements.*

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS
Contact 3M for more information.

311/312 Hazard Categories:
Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - No Delayed Hazard - No

STATE REGULATIONS
Contact 3M for more information.

CHEMICAL INVENTORIES
This product is an article as defined by TSCA regulations, and is exempt from TSCA Inventory listing requirements.

Contact 3M for more information.

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification

Health: 0 **Flammability:** 1 **Reactivity:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

No revision information is available.

DISCLAIMER: The information in this Material Safety Data Sheet (MSDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the MSDS available directly from 3M.

3M MSDSs are available at www.3M.com

3M MATERIAL SAFETY DATA SHEET 3M Desiccant, Tyvek Pouch 12/15/2006

Material Safety Data Sheet

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: 3M Desiccant, Tyvek Pouch
MANUFACTURER: 3M
DIVISION: Electronic Solutions Division

ADDRESS: 3M Center
St. Paul, MN 55144-1000

EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)

Issue Date: 12/15/2006
Supercedes Date: Initial Issue

Document Group: 22-3548-9

Product Use:
Intended Use: Humidity absorption

SECTION 2: INGREDIENTS

Ingredient	C.A.S. No.	% by Wt
Clay Mineral	1302-78-9	>= 99
Silicon Dioxide	14808-60-7	<= 1

SECTION 3: HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Specific Physical Form: Granules
Odor, Color, Grade: No odor. Gray granules.
General Physical Form: Solid
Immediate health, physical, and environmental hazards: Contains a chemical or chemicals which can cause cancer.

3.2 POTENTIAL HEALTH EFFECTS

Eye Contact:
Mechanical eye irritation: Signs/symptoms may include pain, redness, tearing and corneal abrasion.

Skin Contact:
Mechanical Skin irritation: Signs/symptoms may include abrasion, redness, pain, and itching.

Inhalation:
Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

Prolonged or repeated exposure may cause:

Silicosis: Signs/symptoms may include breathlessness, weakness, chest pain, persistent cough, increased amounts of sputum, and heart disease.

Ingestion:
No health effects are expected.

Carcinogenicity:
Contains a chemical or chemicals which can cause cancer.

Ingredient	C.A.S. No.	Class Description	Regulation
Silicon Dioxide	14808-60-7	Group 1	International Agency for Research on Cancer
Silicon Dioxide	14808-60-7	Known human carcinogen	National Toxicology Program Carcinogens

SECTION 4: FIRST AID MEASURES

4.1 FIRST AID PROCEDURES

The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.

Eye Contact: Flush eyes with large amounts of water. If signs/symptoms persist, get medical attention. **Skin**

Contact: Wash affected area with soap and water. If signs/symptoms develop, get medical attention.

Inhalation: Remove person to fresh air. If signs/symptoms develop, get medical attention.

If Swallowed: No need for first aid is anticipated.

SECTION 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Autoignition temperature	*No Data Available*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*No Data Available*
Flammable Limits - UEL	*No Data Available*

Flammable Limits - UEL *No Data Available*

5.2 EXTINGUISHING MEDIA
Use fire extinguishers with class B extinguishing agents (e.g., dry chemical, carbon dioxide).

5.3 PROTECTION OF FIRE FIGHTERS

Special Fire Fighting Procedures: Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards: No unusual fire or explosion hazards are anticipated.

Note: See STABILITY AND REACTIVITY (SECTION 10) for hazardous combustion and thermal decomposition information.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Accidental Release Measures: Observe precautions from other sections. Call 3M- HELPS line (1-800-364-3577) for more information on handling and managing the spill. Evacuate unprotected and untrained personnel from hazard area. The spill should be cleaned up by qualified personnel. Ventilate the area with fresh air. Contain spill. Collect as much of the spilled material as possible. Use wet sweeping compound or water to avoid dusting. Sweep up. Clean up residue. Place in a closed container approved for transportation by appropriate authorities. Dispose of collected material as soon as possible.

In the event of a release of this material, the user should determine if the release qualifies as reportable according to local, state, and federal regulations.

SECTION 7: HANDLING AND STORAGE

7.1 HANDLING
For industrial or professional use only.

7.2 STORAGE
Store under normal warehouse conditions.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS
Not applicable.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection
Avoid eye contact.

8.2.2 Skin Protection
Avoid skin contact.

8.2.3 Respiratory Protection
Under normal use conditions, airborne exposures are not expected to be significant enough to require respiratory protection. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Half facepiece air-purifying respirator with N95 particulate filters. Consult the current 3M Respiratory Selection Guide for additional information or call 1-800-243-4630 for 3M technical assistance.

8.2.4 Prevention of Swallowing
Not applicable.

8.3 EXPOSURE GUIDELINES

Ingredient	Authority	Type	Limit	Additional Information
Silicon Dioxide	ACGIH	TWA, respirable	0.025 mg/m3	Table A2
Silicon Dioxide	OSHA	TWA, respirable	0.1 mg/m3	Table Z-1A

SOURCE OF EXPOSURE LIMIT DATA:
ACGIH: American Conference of Governmental Industrial Hygienists
CMRG: Chemical Manufacturer Recommended Guideline
OSHA: Occupational Safety and Health Administration
AIHA: American Industrial Hygiene Association Workplace Environmental Exposure Level (WEEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Specific Physical Form:	Granules
Odor, Color, Grade:	No odor. Gray granules.
General Physical Form:	Solid
Autoignition temperature	*No Data Available*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*No Data Available*
Flammable Limits - UEL	*No Data Available*
Boiling point	*Not Applicable*
Density	57 - 64 lb/ft3
Vapor Density	*No Data Available*
Vapor Pressure	*No Data Available*
Specific Gravity	*No Data Available*
pH	*Not Applicable*
Melting point	*No Data Available*
Solubility in Water	Nil

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable.

Materials and Conditions to Avoid: None known

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	Not Specified
Carbon dioxide	Not Specified

SECTION 11: TOXICOLOGICAL INFORMATION

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

Not determined.

CHEMICAL FATE INFORMATION

Not determined.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Method: For quantities <100 lbs. (50kg): dispose of waste product in a sanitary landfill. For larger quantities: incinerate in an industrial or commercial facility in the presence of a combustible material. As a disposal alternative, dispose of waste product in a facility permitted to accept chemical waste.

EPA Hazardous Waste Number (RCRA): Not regulated

Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14:TRANSPORT INFORMATION

ID Number(s):
80-0009-5544-5, 80-0009-5545-2, 80-0009-5546-0, 80-0009-5547-8, 80-0009-5548-6, 80-0009-5549-4, 80-0009-5550-2, 80-0009-5551-0, 80-0009-5552-8, 80-0009-5563-5, 80-0009-5564-3

Please contact the emergency numbers listed on the first page of the MSDS for Transportation Information for this material.

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS

Contact 3M for more information.

311/312 Hazard Categories:
Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - Yes Delayed Hazard - Yes

STATE REGULATIONS
Contact 3M for more information.

CHEMICAL INVENTORIES
Contact 3M for more information.

INTERNATIONAL REGULATIONS
Contact 3M for more information.

WHMIS: Hazardous

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification
Health: 1 **Flammability:** 0 **Reactivity:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification
Health: 1 **Flammability:** 0 **Reactivity:** 0 **Protection:** X - See PPE section.

Hazardous Material Identification System (HMIS(r)) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS(r) ratings are to be used with a fully implemented HMIS(r) program. HMIS(r) is a registered mark of the National Paint and Coatings Association (NPCA).

No revision information is available.

3M MATERIAL SAFETY DATA SHEET 3M Desiccant, Tyvek Pouch 12/15/2006

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Solutia Inc.

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: 1020 Nickel Sputter Coated PET Film Laminate

Reference Number: 000000009362 Date: 09/25/2009

Company Information:

United States:
Solutia Inc.
575 Maryville Center Drive, P.O. Box 66760
St. Louis, MO 63166-6760
Emergency telephone: Chemtrec: 1-800-424-9300
International Emergency telephone: Chemtrec: 703-527-3887
Non-Emergency telephone: 1-314-674-6661

Canada:
Solutia Canada Inc.
6800 St. Patrick Street
LaSalle, PQ H8N 2H3
Emergency telephone: CANUTEC: 1-613-996-6666
Non-Emergency telephone: 1-314-674-6661

Mexico:
Solutia MEXICO, S. DE R.L. DE C.V.
Prol. Paseo de la Reforma 2654
Local 501, Piso-5
Col. Lomas Altas
11950 Mexico, D.F.
Emergency telephone: SETIQ: (in Mexico) 01-800-002-1400
Non-Emergency telephone: (in Mexico) 01-55-5259-6800

Brazil:
Solutia Brazil Ltd.
Avenue Carlos Marcondes, 1200
CEP: 12241-420-São José dos Campos/SP-Brazil
Emergency telephone: 55 12 3932 7100 (PABX)
Non-Emergency telephone: 55 11 3146 1800 (PABX)

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Form:	flexible plastic film
Colour:	grey
Odour:	odourless

WARNING STATEMENTS

No significant hazards associated with this material

POTENTIAL HEALTH EFFECTS

Likely routes of exposure: eye and skin contact

Eye contact: Not irritating to eyes.

Skin contact: Not irritating to skin.

Inhalation: This product is non-irritating.

Ingestion: Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.

Refer to Section 11 for toxicological information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS No.	Average concentration	Concentration range	Units
polyethylene terephthalate	25038-59-9		>=98.0	%

4. FIRST AID MEASURES

If in eyes: Immediate first aid is not likely to be required.

If on skin: Immediate first aid is not likely to be required.

If inhaled: Immediate first aid is not likely to be required.

If swallowed: Immediate first aid is not likely to be required.

5. FIRE FIGHTING MEASURES

Hazardous products of combustion: carbon monoxide (CO); carbon dioxide; nickel oxides

Extinguishing media: Water spray, foam, dry chemical, or carbon dioxide
Use extinguishing media suitable to the surrounding fire.

Unusual fire and explosion hazards: None known

Fire fighting equipment: Firefighters, and others exposed, wear self-contained breathing apparatus.
Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Use personal protection recommended in section 8.

Environmental precautions: Keep out of drains and water courses.

Methods for cleaning up: Sweep up into containers for disposal.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling
Handle in accordance with good industrial hygiene and safety practices.
Slip Hazard - Avoid walking on loose film on floor

Storage

Temperature:	> 0 C
General:	Keep in a cool, dry, well ventilated place. Stable under normal conditions of handling and storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne exposure limits: (ml/m3 = ppm)

Eye protection:	Use good industrial practice to avoid eye contact. Film edges could cut cornea.
Hand protection:	No special requirement.
Body protection:	No special requirement.
Respiratory protection:	This material is not likely to present an airborne exposure concern under normal conditions of use.
Ventilation:	No special requirement.

Components referred to herein may be regulated by specific Canadian provincial legislation. Please refer to exposure limits legislated for the province in which the substance will be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

Flash point:	Not applicable
Specific gravity:	>1.0
Melting point :	> 200.00 C
Water solubility:	insoluble

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Conditions to avoid:	None known.
Materials to avoid:	Contact with oxidizing agents. Contact with strong bases. Contact with acids.

Hazardous reactions:	Hazardous polymerization does not occur.
Hazardous decomposition products:	None known;

11. TOXICOLOGICAL INFORMATION

This product has not been tested for toxicity.

Components

Data from Solutia studies and/or the available scientific literature on the components of this material which have been identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) or the Canadian Hazardous Products Act are discussed below if present.

12. ECOLOGICAL INFORMATION

Solutia has not conducted environmental toxicity or biodegradation studies with this material.

13. DISPOSAL CONSIDERATIONS

US EPA RCRA Status:	This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261.
Disposal considerations:	Incineration Recycle municipal waste
Miscellaneous advice:	Local, state, provincial, and national disposal regulations may be more or less stringent. Consult your attorney or appropriate regulatory officials for information on such disposal. This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

US DOT
Other: Not regulated for transport.

Canadian TDG
Other: Not regulated for transport.

ICAO/IATA Class
Other: This material is not regulated under IATA or ICAO for air transportation.

15. REGULATORY INFORMATION

All components are in compliance with the following inventories: U.S. TSCA, EU EINECS, Canadian DSL, Australian AICS, Korean, Phillipine PICCS, Chinese

Canadian WHMIS classification: Not Controlled

SARA Hazard Notification:

Hazard Categories Under Title III Rules (40 CFR 370): Not applicable

Section 302 Extremely Hazardous Substances: Not applicable

Section 313 Toxic Chemical(s): Not applicable

CERCLA Reportable Quantity:

Not applicable

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA/HPA Hazardous Chemical(s) and Section 13 for RCRA classification.

Safety data sheet also created in accordance with Brazilian law NBR 14725

16. OTHER INFORMATION

Product use: Linerless film product

Reason for revision: Error correction, Section 15

	Health	Fire	Reactivity	Additional Information
Suggested NFPA Rating	1	0	0	
Suggested HMIS Rating:	1	0	0	

Prepared by the Solutia Hazard Communication Group. Please consult Solutia @ 314-674-6661 if further information is needed.

MATERIAL SAFETY DATA SHEET

PRODUCT CODE: LF8900C
PRODUCT NAME: Flame Retardant AT Film

SECTION I MANUFACTURER IDENTIFICATION

Manufacturer Name: Engineered Materials, Inc.
Address: 113 McHenery Road, Buffalo, IL 60089
Emergency Number:(423)457-6700 **Information Number :**(423)457-6700
Date Prepared: June 14, 2001 **Preparer:** John W. Scott

SECTION II HAZARDOUS INGREDIENTS / IDENTITY INFORMATION

HAZARDOUS INGREDIENTS	CAS#	OSHA PE	ACGIH TVL	OTHER
1.2 BIS (TETRABROMOPHTHALIMIDO) ETHANE	32588-76-4	N/A	N/A	N/A
AMTIMONY TRIOXIDE	1309-64-4	0.5MG/M3	.05 MG/M3	N/A

THIS PRODUCT IS SUPPLIED IN COMPLIANCE WITH TSCA REPORTING REQUIREMENTS

SECTION III PHYSICAL / CHEMICAL CHARACTERISTICS

BOILING POINT: N/A **SPECIFIC GRAVITY:** available upon request
VAPOR DENSITY: N/A **EVAPORATION RATE:** N/A
SOLUBILITY IN WATER: N/A
APPERANCE AND ODOR: FILM FORM - WHITE

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: N/A
FLAMMABLE LIMITS IN AIR BY VOLUME: LOWER: N/A **UPPER:** N/A
EXTINGUISHING MEDIA: FOAM, CO_2, DRY CHEMICAL, WATER FOG

SPECIAL FIREFIGHTING PROCEDURES: use self-contained breathing apparatus

UNUSUAL FIRE AND EXPLOSION HAZARDS: SEE REACTIVITY DATA

SECTION V REACTIVITY DATA

STABILITY: STABLE

CONDITIONS TO AVOID: TEMPERATURES ABOVE 600°F

INCOMPATIBILITY (MATERIALS TO AVOID):
AVOID STRONG OXIDIZING AGENTS, ACIDS AND BASES.

LF8900C **MATERIAL SAFETY DATA SHEET** **PAGE 2 OF 4**

HAZARDOUS DECOMPOSTION OR BYPRODUCTS:
CARBON MONOXIDE, CARBON DIOXIDE, OXIDES OF NITROGEN, ANTIMONY COMPOUNDS, BROMINE COMPOUNDS AND HYDROCARBONS CAN BE GENERATED DURING THERMAL DECOMPOSITION AND COMBUSTION.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION VI HEALTH HAZARD DATA

INHALATION HEALTH RIKS AND SYMPTONS OF EXPOSURE:
AVAOID BREATHING DUST, IT MAY CAUSE IRRITATION IF EXPOSRE IS PROLONGED OR EXCESSIVE.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE:
PROLONGED OR REPEATED CONTACT MAY CAUSE IRRITATION

SKIN ABSORPTION HEALTH RISKS AND SYMPTONS OF EXPOSURE:
NON-TOXIC

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE:
MAY CAUSE IRRITATION TO THROAT, MOUTH AND STOMACH

HEALTH HAZARDS (ACUTE AND CHRONIC)
WILL NOT PRESENTS ANY HEALTH HAZARDS UNDER NORMAL PROCESSING CONDITIONS HOWEVER, INGREDIENTS USED IN THIS PRODUCT ARE CONSIDERED TO BE HAZARDOUS CHEMICALS UNDER THE FEDERAL OSHA HAZARD COMMUNICATIONS STANDARD 29 CFR 1910.1200.

CARCINOGENICITY: NTP: NO **IARC MONOGRAPHS:** NO
OSHA REGULAED: NO

MEDICAL CONDITIONS GENERALLY AGGRAVATED EXPOSURE:
MAY AGGRAVATE EXISTING RESPIRATORY AND/OR SKIN AILMENTS

EMERGENCY AND FIRST AID PROCEDURES:
FOR MINOR BURNS CAUSED BY MOLTEN PLASTIC MATERIAL, TREAT WITH COLD RUNNING WATER IMMEDIATELY. EYE CONTACT FLUSH WITH WATER FOR 15 MINUTES. IF SWALLOWED DRINK 2-3 GLASSES OF WATER. IN CASE OF INHALATION, REMOVE TO FRESH AIR, WASH HANDS THOROUGHLY WITH SOAP AND WATER. CONSULT A PHYSICIAN IF NECESSARY.

LF8900C MATERIAL SAFETY DATA SHEET PAGE 3 OF 4

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
DISPOSE OF WASTE FILM TO MAINTAIN GOOD HOUSEKEEPING.

WASTE DISPOSAL METHOD:
IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
STORE IN CLEAN DRY AREA

SECTION VIII CONTROL MEASURES

RESPIRATORY PROTECTION:
NOT REQUIRED UNDER NORMAL PROCESS CONDITIONS AND WITH ADEQUATE VENTILATION. HOWEVER, SHOULD CONDITIONS EXIST THAT REQUIRE RESPIRATORY PROTECTION, AND THEN AN ORGANIC VAPOR PROTECTION MASK IS RECOMMENDED.

VENTALATION: LOCAL EXHAUST

PROTECTIVE GLOVES: YES

EYE PROTECTION: SAFETY GOGGLES OR GLASSES

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: NONE

WORK / HYGIENIC PRACTICES: WASH HANDS AFTER HANDLING AND BEFORE EATING

SECTION IX REGULATORY

SARA/TITLE III
THIS PRODUCT DOES NOT CONTAIN A TOXIC CHEMICAL FOR ROUTINE ANNUAL TOXIC CHEMICAL RELEASE REPORTING UNDER SECTION 313 (40CFR 372)

CAS#	CHEMICAL NAME	PERCENT BY WEIGHT
	ANTIMONY COMPOUNDS	<20%

THIS INFORMATION MUST BE INCLUDED IN ALL MSDS THAT ARE COPIED AND DISTRIBUTED FOR THIS MATERIAL

LF8900C MATERIAL SAFETY DATA SHEET PAGE 4 OF 4

SECTION X DISCLAIMER

DISCLAIMER
TO THE BEST OF OUR KNOWLEDGE, THE INFORMATION CONTAINED HEREIN IS ACCURATE. IT IS OBTAINED BY TECHMER PM FROM SOURCES SUCH AS RAW MATERIAL SUPPLIERS AND IS BELIEVED TO BE TRUE. THIS MATERIAL SAFETY DATA SHEET WILL SUPERSEDE ANY THAT WAS PREVIOUSLY RECEIVED, AS IT CONTAINS THE MOST UP TO DATE INFORMATION.

APPENDIX B: SAGE III SAFETY VERIFICATION TRACKING LOG

NSTS/ISS PAYLOAD SAFETY VERIFICATION TRACKING LOG **a. FLIGHT ☐ GROUND X**

c. PAYLOAD/ELEMENT AND MISSION: SAGE III on ISS **d. DATE:** 3/6/2014

e. Log No.	f. Hazard Report Number	g. Safety Verification Number	h. Safety Verification Method (Identified Procedures By Number and Title)	i. Ground Operation(s) Constrained	j. Independent Verification Required (Yes/No)	k. Scheduled Completion Date	l. Completion Date	m. Method of Closure (Comments)
1	NVP-GHR-01	2.1.1	Inspection of NVP hardware and GSE for proper grounding	Y	Y	4/1/14		Test Procedure
2	NVP-GHR-01	3.2.1	Approval of EGSE handling, checkout, and testing procedure	Y	N	4/1/14		Approval of Test Procedure
3	NVP-GHR-01	4.1.1	Review test procedure to ensure testing of KSC facility three phase power receptacle prior to conducting test procedure.	Y	N	4/1/14		Test Procedure

JSC Form 764 (Rev April 22,1999) (MS Word September 1997)

APPENDIX C: CERTIFICATE OF NSTS/ISS PAYLOAD SAFETY COMPLIANCE

CERTIFICATE OF NSTS/ISS PAYLOAD SAFETY COMPLIANCE FOR

1) **Hardware addressed on this Certificate:**
   a) Payload Name (Acronym): SAGE III NVP
      i) If multiple components identify here or add attachment: _____
   b) Launch vehicle(s)/launch Carrier(s)*: SpaceX
   c) Return vehicle/hardware disposal*: N/A
   d) Hardware On-Orbit Operations (vehicle/ISS Segment): ISS/ELC-4

   Note: This 1114A certification is for operations on the **Shuttle and ISS (excluding the Russian Segment). It also addresses **Shuttle** launch/return. Launch/**return**/disposal on other vehicles requires adherence to the unique certification process as dictated by the applicable vehicle/IP process requirements.*

2) **Certification Applicability:** applicable to

   _____ Payload Design and Flight Operations

   X Ground Support Equipment Design and Ground Operations

3) **The Payload Organization Hereby Certifies that:**

   _____ For STS, the Payload Hardware Identified on this Form Complies with all Applicable Requirements of the NSTS 1700.7 (current issue), "Safety Policy and Requirements for Payloads Using the National Space Transportation System", and/or KNPR 8715.3, "KSC Safety Practices Procedural Requirements", Chapter 20.

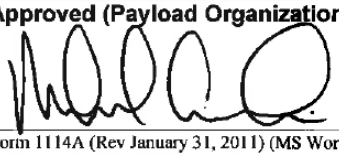
   X For ISS, the Payload Hardware Identified on this Form Complies with all Applicable Requirements of the NSTS 1700.7 (current issue), "Safety Policy and Requirements for Payloads Using the National Space Transportation System", NSTS SSP 51700, "Payload Safety Policy and Requirements for the International Space Station", and/or KNPR 8715.3, "KSC Safety Practices Procedural Requirements", Chapter 20.

   1) The Safe Design Life is Unlimited for ground processing from _____ (date). This is the time period the payload can be retained at or restored to a specified safe condition using prescribed resources and procedures. The limiting component(s) the determined this safe design life is (are) N/A, which requires (recalibration, repair, replacement, etc).

   2) The Safe Operational Life is Unlimited for ground processing from _____ (date). The limiting component(s) that determined this safe operational life is (are) N/A, which requires (recalibration, repair, replacement, etc).

4) **Approved Waivers/Deviations:** N/A

5) **Approved (Payload Organization Manager) and Date:**



3/6/14

JSC Form 1114A (Rev January 31, 2011) (MS Word September 1997)

APPENDIX D: ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AFRAM	Active Flight Releasable Attachment Mechanism
AIT	Analysis and Integration Team
ARHR	Accepted Risk Hazard Report
CONOPS	Concept of Operations
COTS	Commercial-Off-The-Shelf
DC	Direct Current
EDU	Engineering Development Unit
ELC	ExPRESS Logistics Carrier
EMI	Electro-Magnetic Interference
EMC	Electromagnetic Compatibility
EMU	Extravehicular Mobility Unit
EOP	Earth Orbit Propagator
ESA	European Space Agency
ESD	Electrostatic Discharge
ExP	ExPRESS Pallet
ExPA	ExP Adapter
ExPRESS	Expedite the Process of Experiments to Space Station
FC	Flight Computer
FHR	Flight Hazard Report
FOD	Foreign Object Debris
FOS	Factor of Safety
FRAM	Flight Releasable Attachment Mechanism
GSDP	Flight Safety Data Package
FSE	Flight Support Equipment
FSW	Flight Software
GND	Ground
GSE	Ground Support Equipment
GSRP	Ground Safety Review Panel
HDBK	Handbook
HiPot	High Potential
HW	Hardware
Hz	Hertz
IP	Instrument Payload
ISS	International Space Station
ISSPO	International Space Station Program Office
JSC	Johnson Space Center
KNPR	Kennedy NASA Procedural Requirements
KSC	Kennedy Space Center

Acronym	Definition
LaRC	Langley Research Center
M&P	Materials and Processes
MAPTIS	Materials and Processes Technical Information System
MAQAL	Material Analysis and Quality Assurance Laboratory
MDP	Maximum Design Pressure
MIP	Mandatory Inspection Point
MLI	Multi-layer Insulation
MPE	Maximum Permissible Exposure
MUA	Material Usage Agreement
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NATC	NASA Threaded Coupling
NCR	Noncompliance Report
NDE	Nondestructive Engineering
NVP	Nadir Viewing Platform
OCAD	Operational Control Agreement Document
PAP	Product Assurance Plan
PFAP	PFRAM Adapter Plate
PFRAM	Passive Flight Releasable Attachment Mechanism
PFIP	PFRAM Interface Plate
POIC	Payload Operations and Integration Center
PSRP	Payload Safety Review Panel
PWR	Power
QA	Quality Assurance
SAGE III	Stratospheric Aerosol and Gas Experiment III
SA	Sensor Assembly
SSPF	Space Station Processing Facility
SVTL	Safety Verification Tracking Log
TAS-I	Thales Alenia Space - Italy
TBD	To Be Determined
TBS	To Be Supplied
V&V	Verification and Validation
VDC	Volts, Direct Current